

New technique for transabdominal sonographic fetal heart axis determination: 4D method

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Abstract

The aim of this paper is to describe a new method to determine the fetal heart axis using 4D features of ultrasound.

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Introduction

It is critical to determine the fetal situs and fetal heart axis during fetal echocardiography. The diagnosis of a number of complex cardiovascular diseases (Kartagener's syndrome, heterotaxy syndrome, congenital heart disease, etc.) is only feasible after determining the fetal heart axis. However, this is not always straightforward; on the contrary, the assessment of the fetal heart is more challenging and time-consuming than that of other organs [1]. Therefore, a method that is easy to apply and takes a short time to learn is needed. We have developed a more practical method for fetal heart assessment using the 4D capabilities of today's ultrasound devices.

Fetal axis determination technique using transabdominal 4D

First method

Step 1: A 4D image is taken of the fetal face and thorax (Figure 1), and the position of the fetus is adjusted so that it faces the physician performing the ultrasound (Figure 2).

Step 2: Then, by adjusting the gain settings of the ultrasound, movement into the fetus is made. It is not important to get a quality image at this time. It is then easily visualized whether the heart and stomach are on the left or right (Figure 3a-b).

Sometimes the position of the fetus is not suitable. We can determine the heart position by taking the 4D application from the spine (Figure 4) and moving into the fetus with the help of gain (Figure 5).

Second method

Step 1: In the first stage, a 4D image of the fetus is taken, including the face and thorax (Figure 1).

Step 2: The position of the fetus is then adjusted so that it faces the doctor performing the ultrasound (Figure 2).

Step 3: Then chosen as the decisive point. This can be a hand, cord or foot. After determining the position of the fetal decisive point (for example left arm) (Figure 6) in relation to the thorax and fetal head, the heart is positioned in 2D mode to determine whether the heart is on the left arm side or not (Figure 7).

Sometimes the left and right extremities of the fetus may be in the same position. This might complicate the orientation of the heart. In this case use first method.

Cordes et al. [2] first described a technique to determine fetal cardiac situs in 1994. In this technique, the ultrasound probe is first accelerated parallel to the fetal cranial-caudal axis. Then,

after determining the fetal head orientation, the ultrasound probe is rotated 90 degrees clockwise to make a transverse section of the thorax. The 'ball' part of the probe is then designated as the right side and the opposite side as the left side. This method is reliable but difficult to learn and apply. This is because the right and left fetal position is differentiated by the position of the mother, the orientation of the probe, and the video screen.

The anatomical correlation of the heart with neighboring organs (stomach, gallbladder to the left of the umbilical cord, etc.) may be useful in determining the fetal cardiac axis. However, it should be kept in mind that determining the position of the heart can be misleading when these anatomical landmarks are malrotated.

Bronshtein et al. [3] described a technique to determine the fetal heart axis using the left hand for transvaginal sonography and the right hand for transabdominal sonography. In this method, the dorsal side of the doctor's forearm points to the fetal back, and the thumb points to the fetal left side. Although this method may seem easier, it is a very challenging method for doctors who have difficulty distinguishing between left and right. Gormley et al. [4] found that 34% of the medical students had difficulty distinguishing between left and right and therefore used a range of techniques for left and right identification. This study shows that the number of physicians having difficulty distinguishing between their left and right is not negligible.

Dursun et al. [5] proposed the clock position method to determine the fetal heart axis. In this method, an individual sits on the patient's right side and holds the ultrasound probe with the right hand, and the thoracic cavity is considered as a clock face, with the fetal spine representing the 12 o'clock position. If



Figure 1: 2D image of the foetal face and thorax.



Figure 2: A 4D picture of the fetus in the position facing the doctor performing the ultrasound.

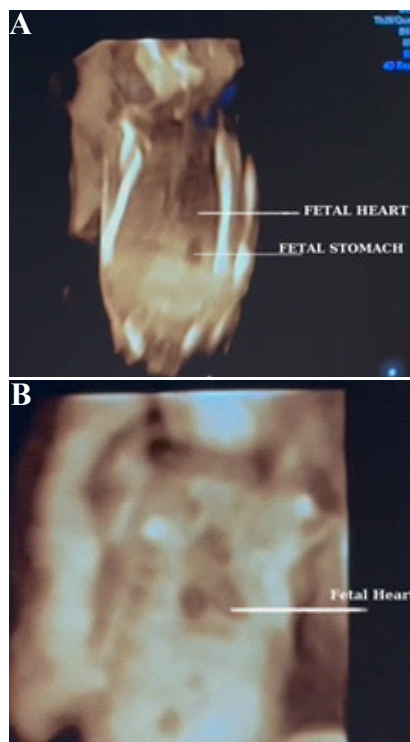


Figure 3: With the help of Gain enter the fetus and determine the position of the heart and stomach.



Figure 4: 4D Picture of Fetal spine.

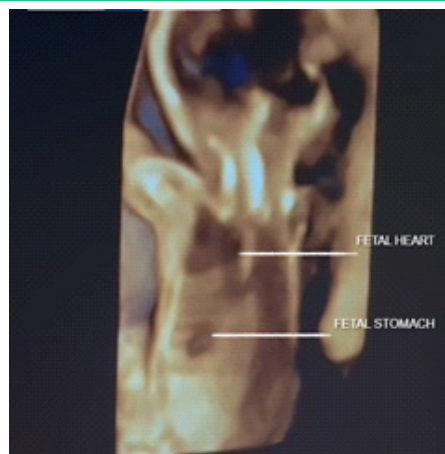


Figure 5: Determination of heart position from the spine of the fetus.



Figure 6: Determination of right hand relative to the thorax and heart.



Figure 7: Confirm the position of the fetal heart relative to the right hand with 2D ultrasound.

the fetus is in breech presentation, the axis of the heart is positioned approximately at 7 o'clock, and if the fetus is in cephalic presentation, the axis of the heart is positioned approximately at 5 o'clock. This method is challenging to use when the fetus is in the transfer position.

Nowadays 4D is widely used. Almost all ultrasounds have this feature and are used rationally. So why not use 4D of ultrasounds? Our technique that we have presented is easier to learn and apply than other techniques and does not cause directional perception difficulties. We also believe that it is a suitable option for clinicians as it is not affected by fetal movements.

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